Soil Arthropods Diversity at Mt. Arjuno Trails, Subdistrict of Prigen, District of Pasuruan, East Java

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Abstract: This research was aimed to study the soil arthropods diversity of Mount Arjuno hiking trails, Prigen Subdistrict, Pasuruan District. The sampling location was choosen based on the vegetation composition, altitude and accessability. Specimen was collected using pitfall trap method then the collected sample was identified to the lowest taxon of the classification system. Based on the result, there was 11 orders and 9 families classified. Entomobryomorpha order was found as the highest population at the fourth location. The result of Shannon-Wiener index in total location was (H'=1,46). The highest diversity index was at the first location (H'=1,61) with high number of Staphynilidae in location. This research has shown that almost all soil arthropods in Mount Arjuno hiking trails in Tretes Subdistrict, Pasuruan District, are on medium level in playing role as detritivore and decomposer.

1. INTRODUCTION

Indonesia is the country that located at ring of fire and also has high number of biodiversity. The various geographical phenomena are aquatic, terestrial, hill, and mountain. More than 25% world species with unique characteristics can be found in Indonesia (Pelawi, 2009; Permana, 2015). Mount Arjuno is located in District of Pasuruan and Mojokerto, Province of East Java. Mount Arjuno is an active volcano with the highest peak of 3,339 masl (Nidya, et al., 2013).

Mountain is geographical phenomena that has high potential on supporting animal and plant life. It has potentiality shown the high number of animal diversity, espescially soil arthropods (Ruslan, 2009). Arthropods have been existing since 350 million years ago. Annotated list has 1 million species from 10 million unidentified species that are predicted (Borror, et al,. 1994; Permana, 2015).

Soil arthropod is an insect that has a part or a whole life cycle in soil or the surface. This arthropod has an important role on ecosystem, for example as an bioindicators for ecosystem stability. Soil arthropod has high function as detitrivore to decompose organic material and other mineral into simple-shaped molecules that are important for supporting soil stability. Plant nutritions from every litterfall always go through decomposition process. The importance of soil arthropods is also to support other plant, for example to be an polinator, predators for pest animal, and an indicators for ecosystem health. Some of soil arthopods are also detrimental to ecosystem, for example, arthropods that are plant infectors (Permana, 2015; Fauziah, 2016; Samudra, et al., 2013; Ardillah, et al., 2014; Nidya, 2013; Soedijo and Pramudi, 2015; Afandhi, et al., 2015; Sari, 2014).

Mentioned statement has shown that the soil arthropods have an important role espescially on a mountain that is habitat for animal and plants. Soil arthropods at Mount Arjuno have never been studied before. This research aimed to study the soil arthropods diversity at Mount Arjuno hiking trails in Prigen Subdistrict, Pasuruan District, East Java.

2. METHOD

2.1. Location

This study was conducted at Mount Arjuno hiking trails that are located in Prigen Subdistrict, Pasuruan District. The location of hiking trails is at coservation area of Taman Hutan Raya Raden Soerjo. This hiking trails are very popular as Tretes trails and it is easy to acces because the distance is near from Kakek Bodo Waterfall tourism.

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Table 1: Research Location

Location	Coordinate
1	S 7°40'53.7", E 112°38'19.3"
2	S 7°42'5.7", E112°37'39.5"
3	S 7°42'18.4", E 112°37'36.9"
4	S 7°43'21.2", E 112°36'57.7"

This study was conducted in four different locations that spread at the hiking trails. Research locations were chosen based on vegetation composition, altitude difference, and accessability. The coordinates of the research location are shown in table 1.

2.2. Specimen Collection

The specimen was collected by six pitfall traps that were spread on each research location. Each pitfall trap worked for twenty four hours before the specimen was harvested. Specimen was collected in November 2016, then sorted and washed before stored at 70% ethanol (see table 2).

Table 2: Specimen collected

Ordo	Family	L1	L2	L3	L4	∑
Hymenoptera	Formicidae	29	32	10	0	71
Diptera	Acroceridae	1	0	0	0	1
	Tipulidae	1	0	0	0	1
	Sciaridae	0	0	0	1	1
Entomobryomorpha	Entomo[1]	12	29	56	102	199
	Entomobrydae	0	0	2	401	403
Coleoptera	Chrysomelidae	18	10	1	0	29
	Amphizoidae	2	0	0	0	2
	Staphynilidae	50	11	1	2	64
Phthiraptera	Philopteridae	1	0	7	0	8
Orthoptera	Trydactylidae	8	0	0	0	8
Dermaptera	Dermaptera[1]	0	3	0	0	3
Isoptera	Isoptera[1]	0	1	1	0	2
Blattaria	Blattodea	0	1	0	0	1
Arachnida	Arachnida[1]	1	5	3	3	12
H'		**1.6**	**1.2**	**0.9**	**0.5**	**1.4**

2.3. Specimen Identification

Collected specimen was identified by identification book from Borror, et al., (1994). Each specimen was identified to the lowest taxon. Obtained number and taxon were then analized.

2.4. Data Analisys

Identification results were then analized using heterogeneity index from Shannon-Wiener to measure diversity. This was Shannon-Wiener Index equation,

$$H' = Pi\ LN\ Pi \quad (1)$$

remarks :
H' = Heterogeneity Index (Diversity)
Pi = Proportion of number of each taxon/total sample.

3. RESULT AND DISCUSSION

Research on Mount Ajuno-Welirang, Prigen Subdistrict, Pasuruan District, resulted in 11 orders and 9 families classified. Entomobryomorpha specimen has a higher number than the others. The highest population was founded in the 4th location. Shannon-Wiener index analysis has shown the value of H'=1,46. This value was higher than the arthropod diversity at Organic Vegetable Field in Subdistrict of Trawas, District of Mojokerto, which showed value of H = 1,40 (Samudra, et al., 2013). However, this value was less than arthropod diversity at Ranu Pane Restoration Area in District of Lumajang (Ardillah, et al., 2014).

High value of Shannon-Wiener index indicates ecosystem stability. Higher value means animal abundantly support the ecosystem. Ecosystem stability means that the food chain is in balance. Other influental factors to the Shannon-Wiener index value is species mobility, geographical phenomena, etc (Schowalter, 2016).

Figure 1: Staphynilidae Specimen

At the first location, the highest number of individuals is from Staphynilidae. This family is easy to be identify by their short elytra. Their elytra commonly has never been longer than their body width. This family has a big abdomen with the end is visible. Their role is as detritivore in ecosystem. Staphinilids are usually found in leaf debris, under

rock and decaying material (Borror, et al., 1994). At the first research location, the whole ground was almost covered by the leaf debris. The condition showed that Staphinilids play its role as an detritivore here. It changed leaf debris into smaller size so that decaying process will work faster

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Figure 2: Formicidae Specimen

The highest number of individuals at 2nd location was from family of Formicidae. The role of this family is as predators in its habitat. It also can be detritivore in ecosystem. Some of them are carnivore, herbivore, and omnivore. The carnivore ones usually eat dead animal and the herbivore ones eat fruits or other glucose sourcea. This family lives in a colony and exhibits polymorphism. It is considered to be the most succesfull family on Earth and can be found all over the Earth (Hashimoto, 2003).

Figure 3: Collembola Specimen

Figure 4: 3rd Research location

The highest number of individuals at 3rd and 4th location was from the order of Entomobryomorpha. It is classified on Collembola class in taxonomy. This order was very common but difficult to find because it is very small on size and also lives in hidden place. Its size is usually between 0.25 – 6 mm. Collembola that lives on soil surface decomposes dead vegetation and mushroom. The other collembola also eats other arthropods feces, pollen, algae etc. (Borror, et al., 1994; Suhardjono, et al., 2012).

Due to the observation result, the Collembola population was higher based on altitude. The first location is ± 550 masl on altitude. The fourth location with 503 Entomobryomorpha specimen is ± 1650 on altitude. Higher altitude has correlation with average temperature in which each 100 m increase in altitude will decrease the temperature of 0.6°C. The temperature is correlated with plant physiology and also vegetation composition (Ziello, et al., 2009). The vegeteation composition that is the main source of animal necessity should be correlated with the animal diversity

4. CONCLUSION

Based on this study, there were 11 orders and 9 classified families of arthropod found at Mount Arjuno hiking trails. The total of Shannon-Wiener index was *H'*= 1.46 with the highest index was at first location with *H'*= 1,61. The highest number of individuals was from Entomobryomorpha order. This research has shown that almost all soil arthropods at Mount Arjuno hiking trails in Tretes Subdistrict, Pasuruan District, are on medium level in playing role as detritivore and decomposer.

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